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Technology Submission Review

Topic: Developing teaching material using a combination of
data mining, machine learning, crowdsourcing techniques

Online education and learning are topics that are very much proliferating in the past few years. There are many universities that have been offering classes online already and I am currently a graduate student of a fully online mcs-ds degree. But this year specifically because of the pandemic a lot of schools of different education levels, has offered services of online learning. This paper will be a review of different technologies that were built to help make online education more efficient and effective. Specifically, we will be reviewing AXIS and ConceptScape.

High quality and up-to-date explanations to questions can be as important, if not more, than the answers themselves since students can just bruteforce solving the answers without understanding how they arrived to it. AXIS or Adaptive eXplanation Improvement System aims to effectively address this concept. AXIS has two main components: the learnersorurcing interface which asks students to say their level of knowledge, ask them to create, edit, and rate explanations while they are solving a problem; and the explanations selection policy which uses machine learning to pick which of these explanations will be used by future students based on the ratings by the previous batch of students. Because this process only requires the learners to participate, this saves instructors time and leverage for those who have fewer resources. They framed their explanation selection as a multi-armed bandit problem, meaning to use an action over and over and to learn which action is most effective based on results. They used Thompson sampling which was a type of Bayesian algorithm which is aimed specifically for practical problems. The explanations that were generated through AXIS were comparable even to experienced instructors. For their method, they had a 150-sample group where they first gave their school and work experience in order to differentiate them by knowledge and expertise on the topic. Another way their knowledge was measured was by how many questions they

answered correctly/incorrectly. They were presented with math problems and after they answered each question, they were either shown an answer and explanation for that answer or be asked to explain the answer. AXIS would then rate these explanations and then add the highest rated explanation to the explanation pool to arrive with the best explanation. The experiment showed that as more learners use the system, the explanation rating grows higher starting even below learner explanation rating and then later on being almost comparable to the explanations given by the instructional designers.

It is extremely hard to find the parts of a video if we only want to view a certain topic. For text-based lectures and classes we usually have a search function or find tool that can direct us to the word we are looking for and will save us time especially for larger documents. ConceptScape addresses this problem by generating a concept map for each video where the watchers can add in their input after watching the video to improve this mapping. Each concept in the map is linked to a specific time in the video where it is introduced and explained by the instructor. Learners will be allowed to edit this map. To create these concept maps where they had to start with an empty concept list, they provided 8 steps. First is the learners are asked to fill up their own concept maps and using MeaningCloud, will pick the shortest and most contributed concepts while picking the earliest time. Next, these learners are provided with these new concept lists and asked to adjust these concepts in terms of deleting duplicate or unnecessary concepts and adjusting timestamps. The concepts are then asked to be linked to each other, where the links only made by one learner is removed and the others are saved. The next step is the learners are then showed this link and ask to improve the connections in order to make sure that concepts that are important but was removed in previous steps are included but also make sure the links are improved. Like before, duplicate, or unnecessary links are removed. Then they are asked to label these links. Last step is the learners are asked to vote on which link label is the most representative of the relationship. In their results we can see that both the holistic score and total component score of the concept maps are very much close between ConceptScape and experts and a huge improvement from novices.

References

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